Monitoring & Leak Detection With Smart Pigging

ROSEN

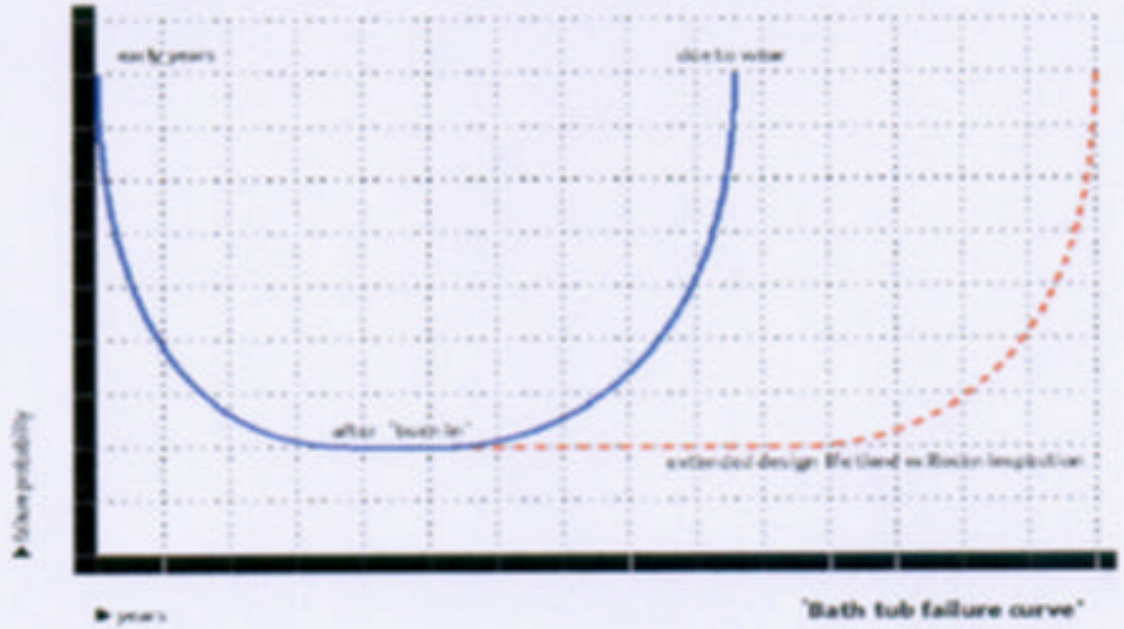
Inspection Technologies

Alaskan Arctic Pipeline Workshop

Anchorage, Alaska November 8-9, 1999

The Challenge

Engineering facilities follow a bath tub probability curve toward structural failure



Monitoring by Inline Inspection

- Engineering Structures must be built in a way which allows for inspection if necessary.
- First inspection is often performed shortly after construction to verify it was built to specification.
- Repeated inspections are typically performed at intervals determined by risk analysis.
- Approximately 60000mls of pipeline are internally inspected per year worldwide.

Inline Leak Detection

Technique's:

- Acoustic Emission
- Pressure Differentials
- MFL Surveys

but

'A line is monitored in a way that it does not deteriorate to a point where a leak occurs'

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Inline Inspection

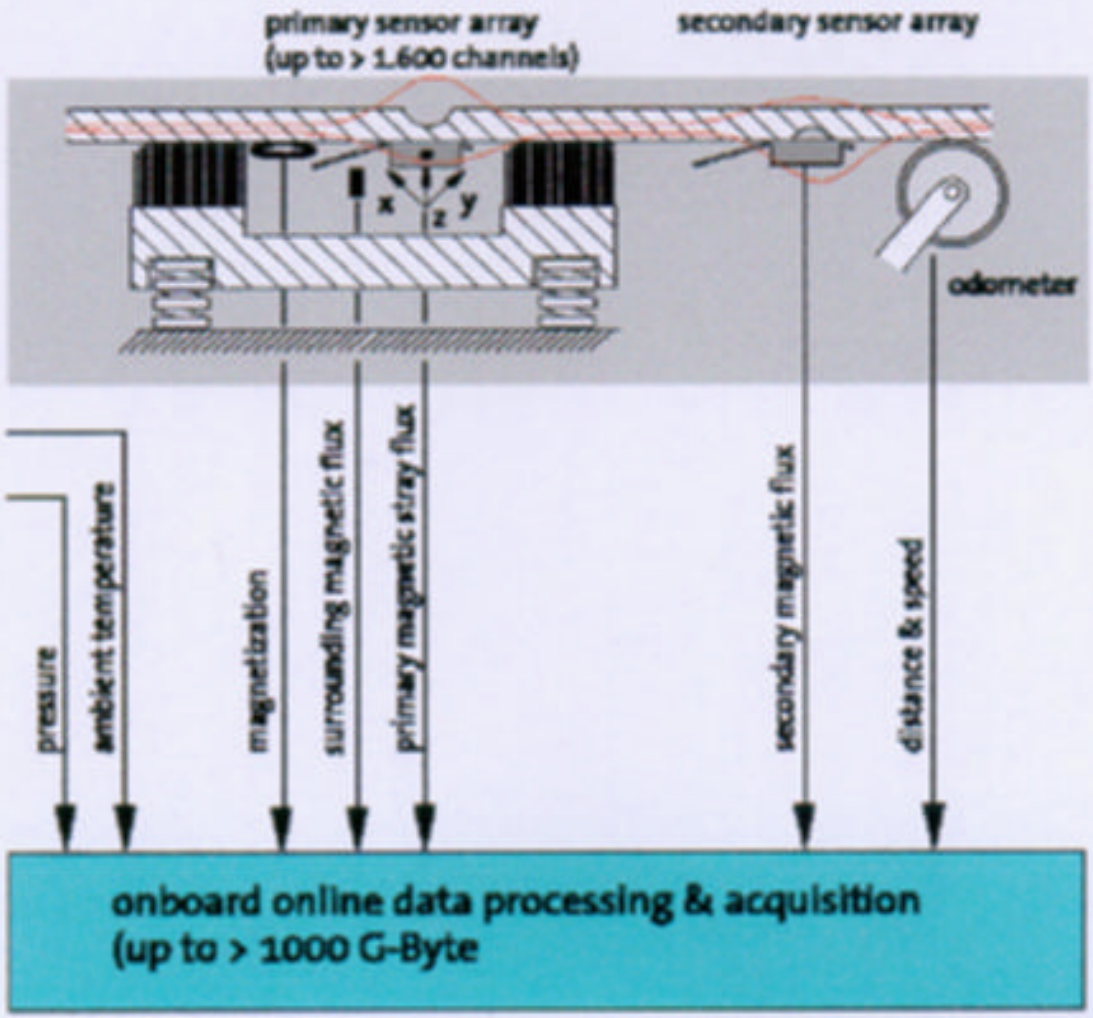
Keywords for Monitoring are:

- Sensitivity
- Repeatability

Sensitivity to make sure that defect areas are detected as early as possible to allow for remedial action.

Repeatability to allow comparison of subsequent runs.

Inline Inspection - MFL



Inline Inspection

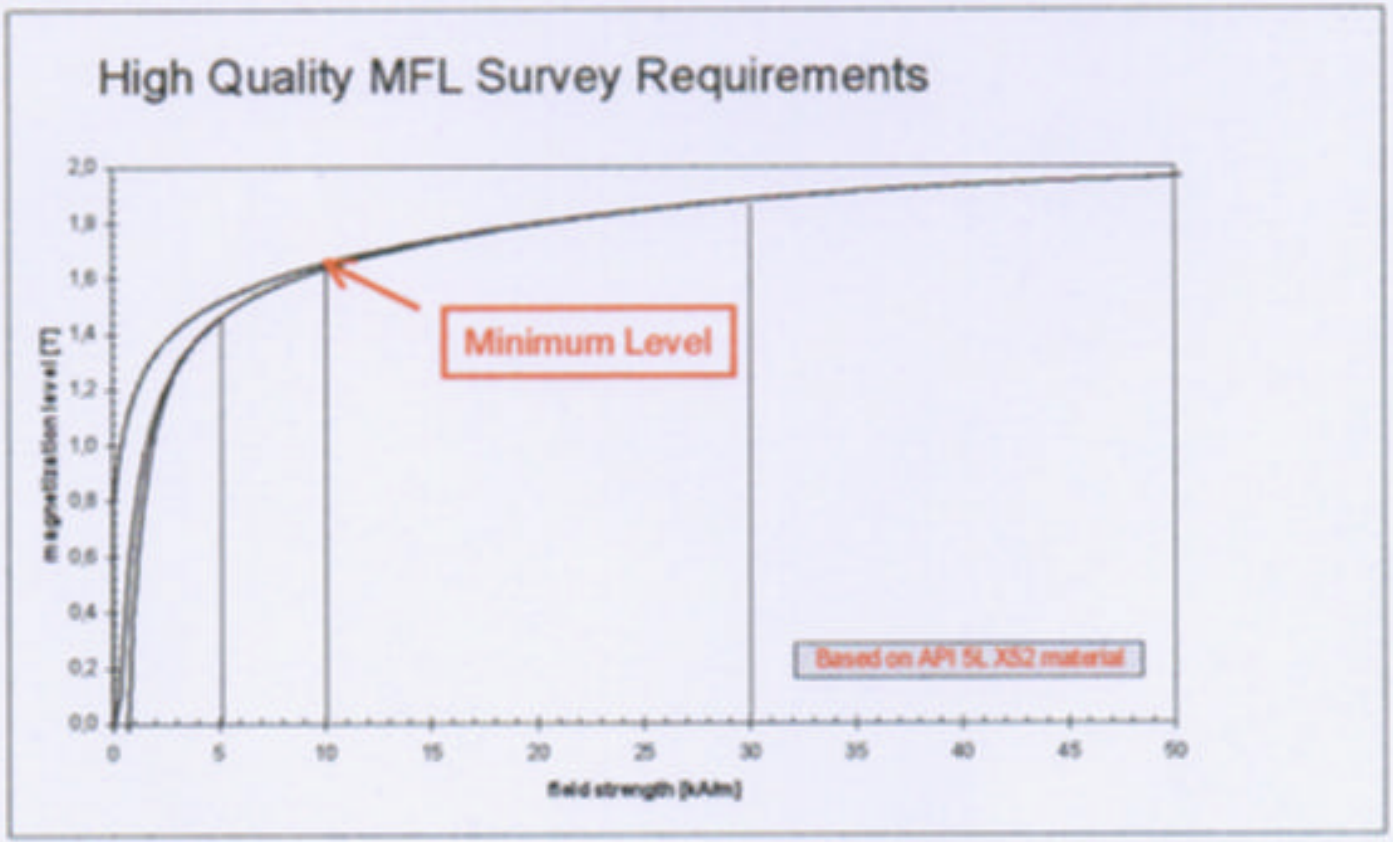
In the past inspection of small diameter heavy wall pipe was often not feasible. The main reasons were:

- Insufficient Magnetization
- Insufficient Resolution

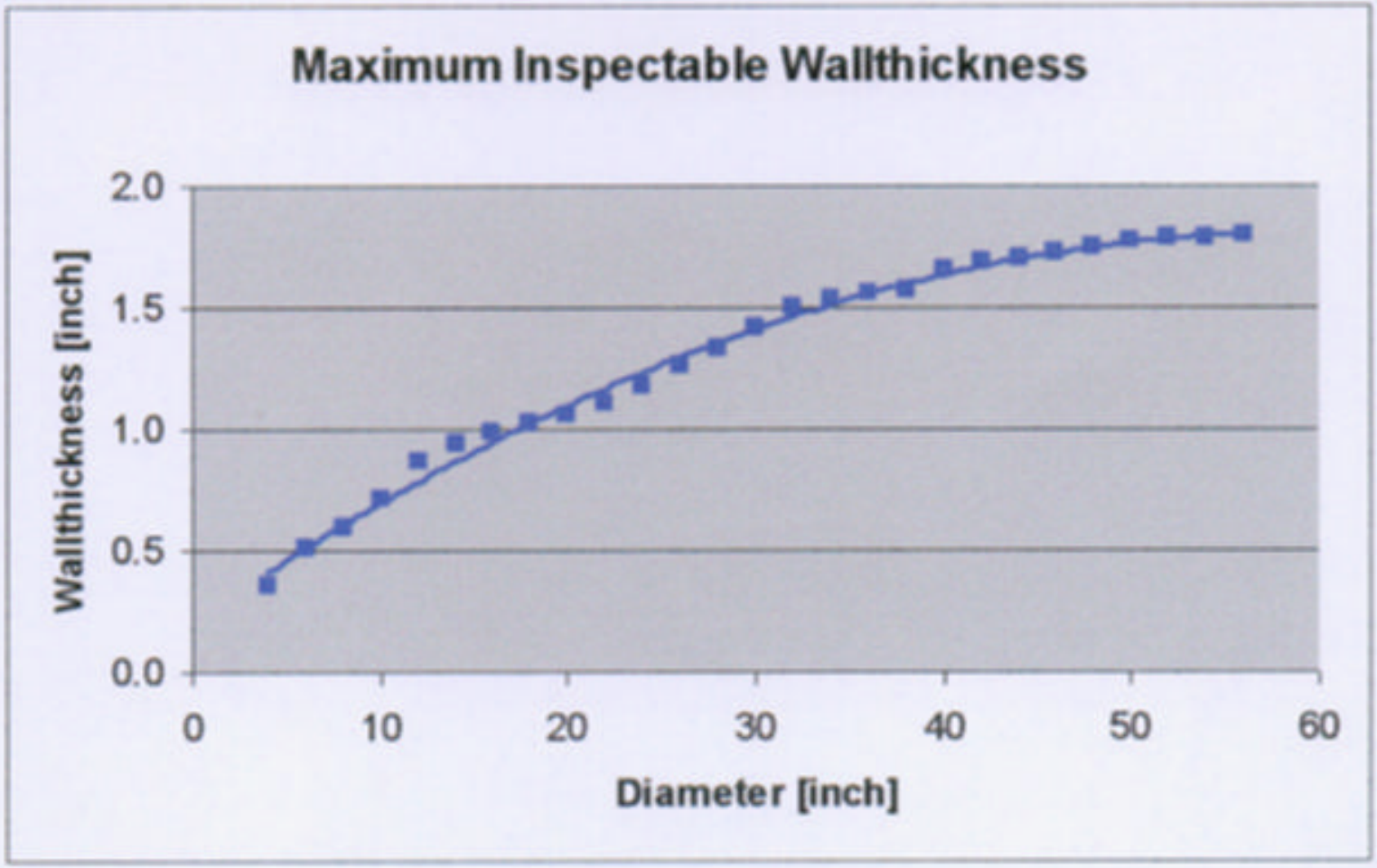
Recent advances in electronic and materials technology have lead to a significantly enhanced situation.

Sensitivity

Magnetization Level



Sensitivity



Sensitivity

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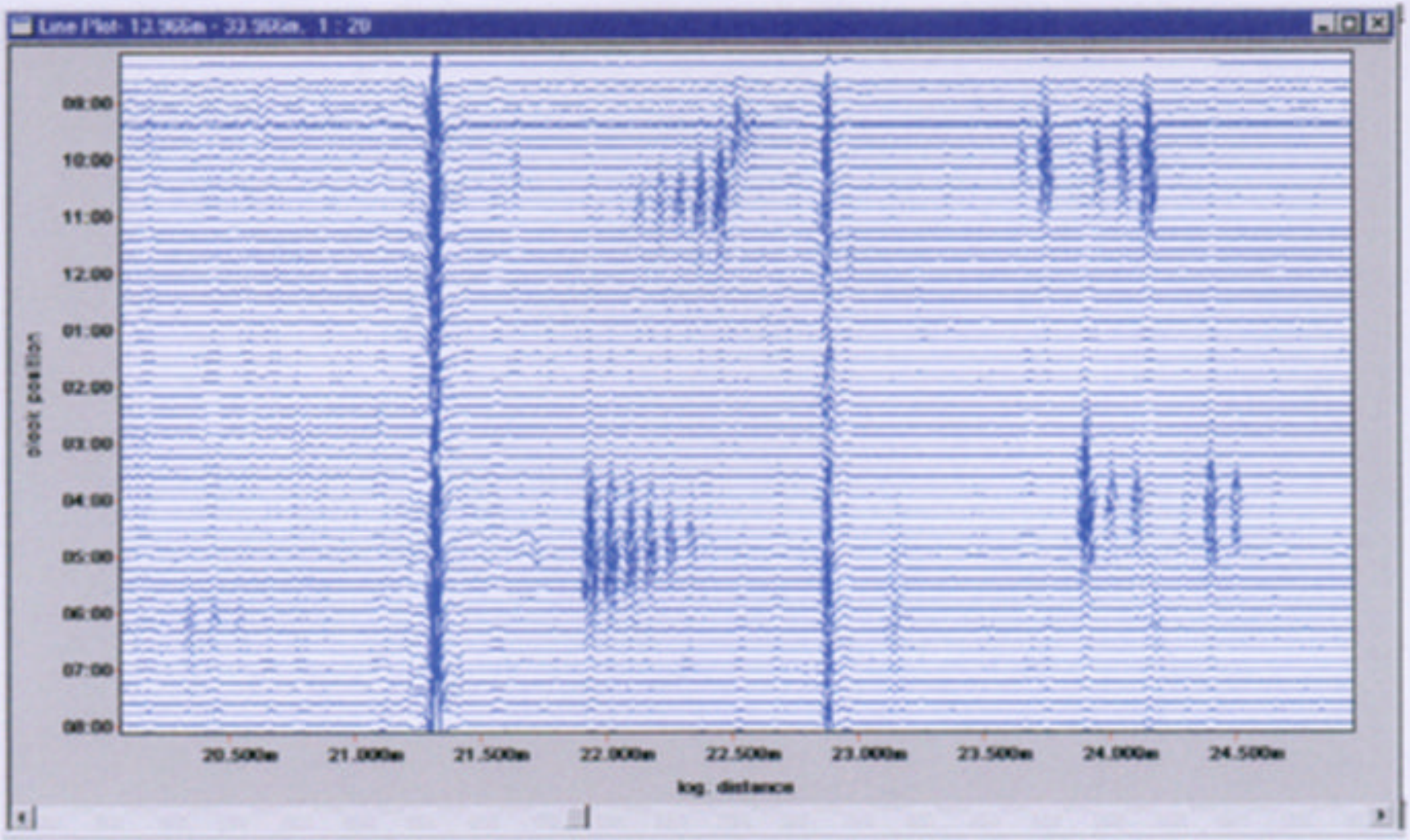
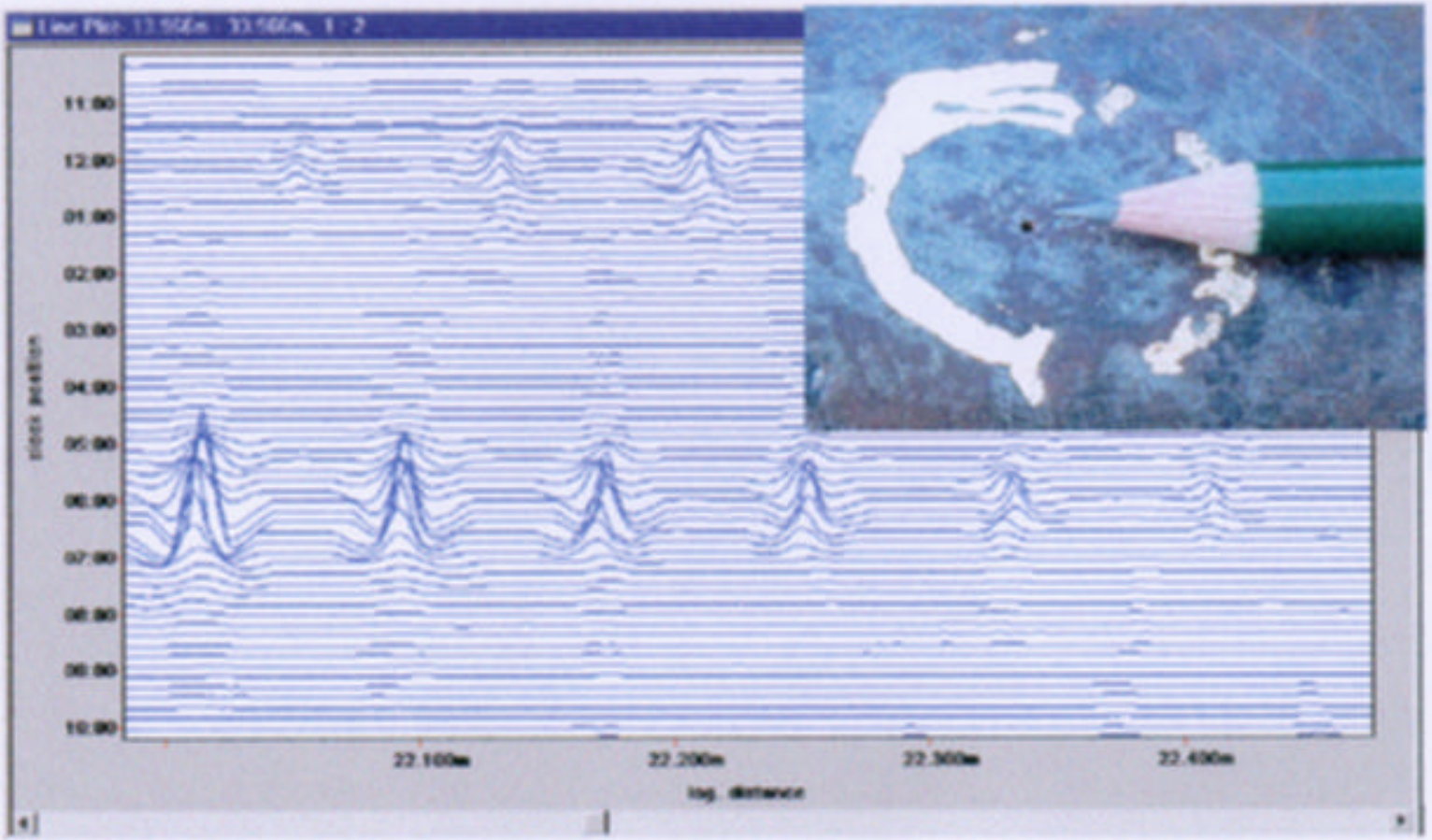


Sensitivity



Sensitivity

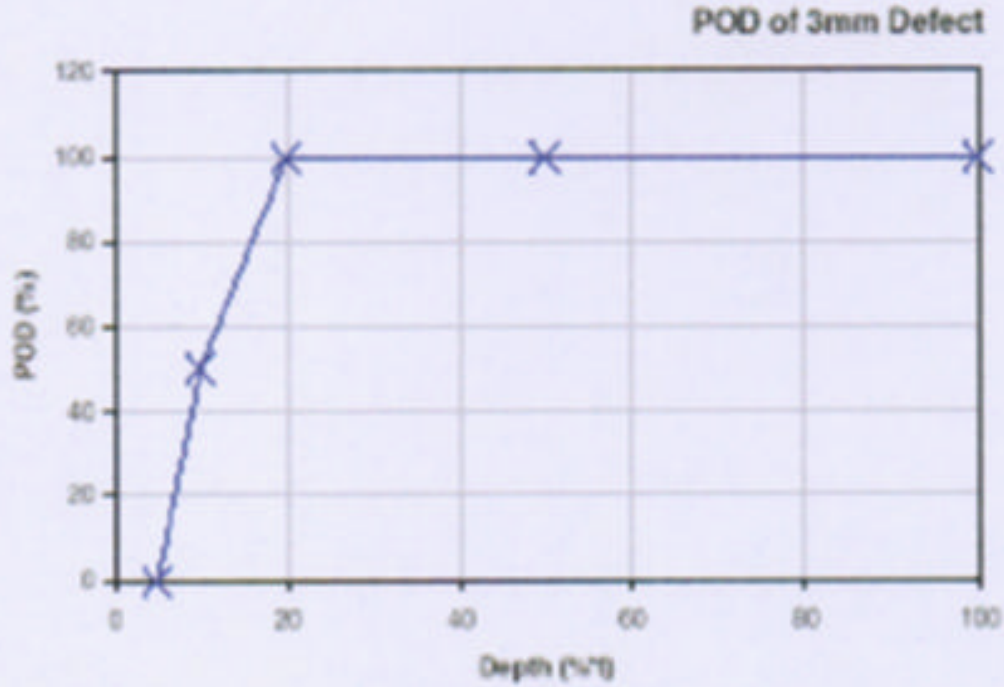
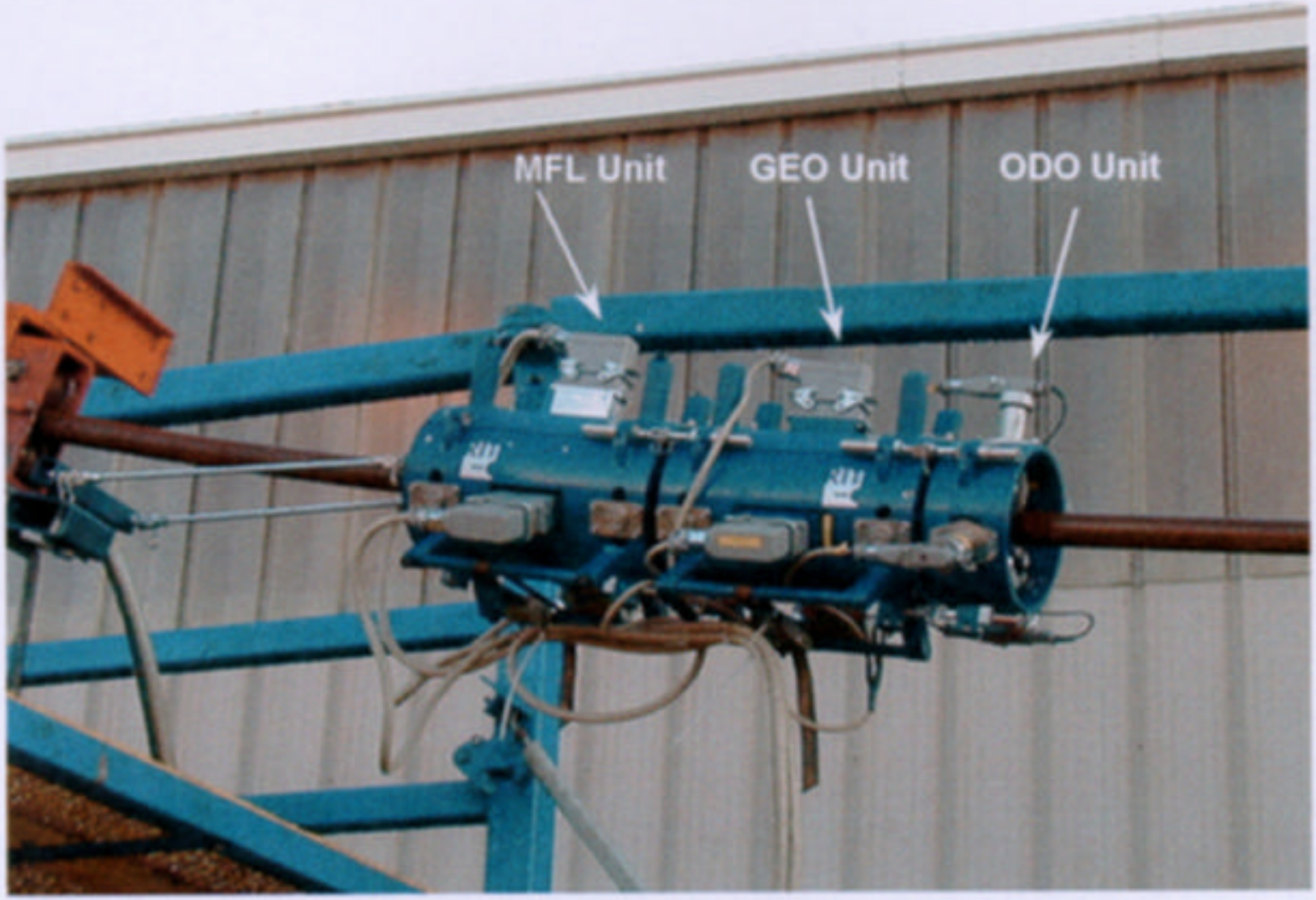


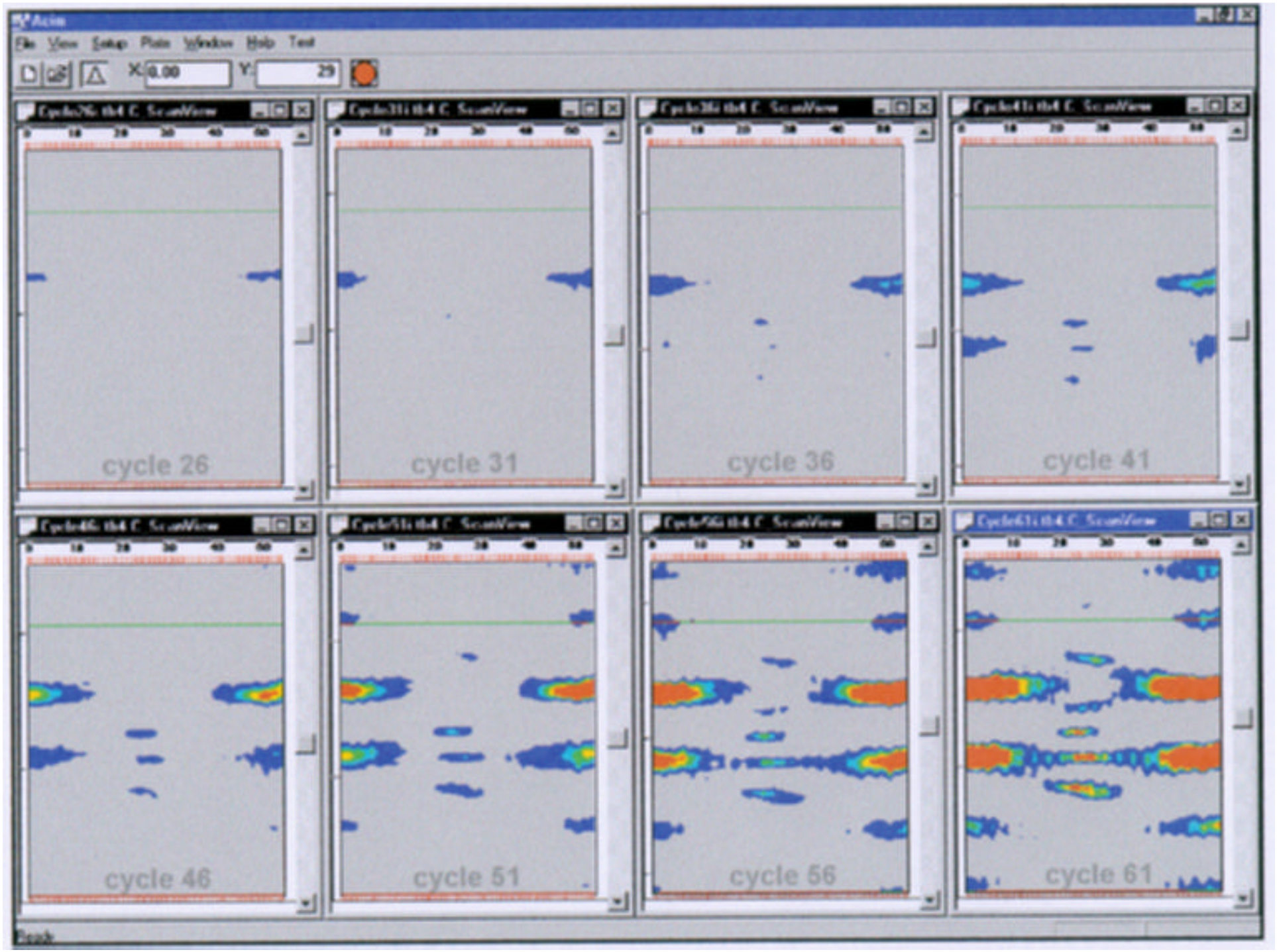
figure2 : POD of a 3mm pinhole, derived from a total number of 32 features obtained from four pull tests.

Repeatability - ACIM

Automatic Coiled Tubing Integrity Monitoring System

Repeatability - ACIM



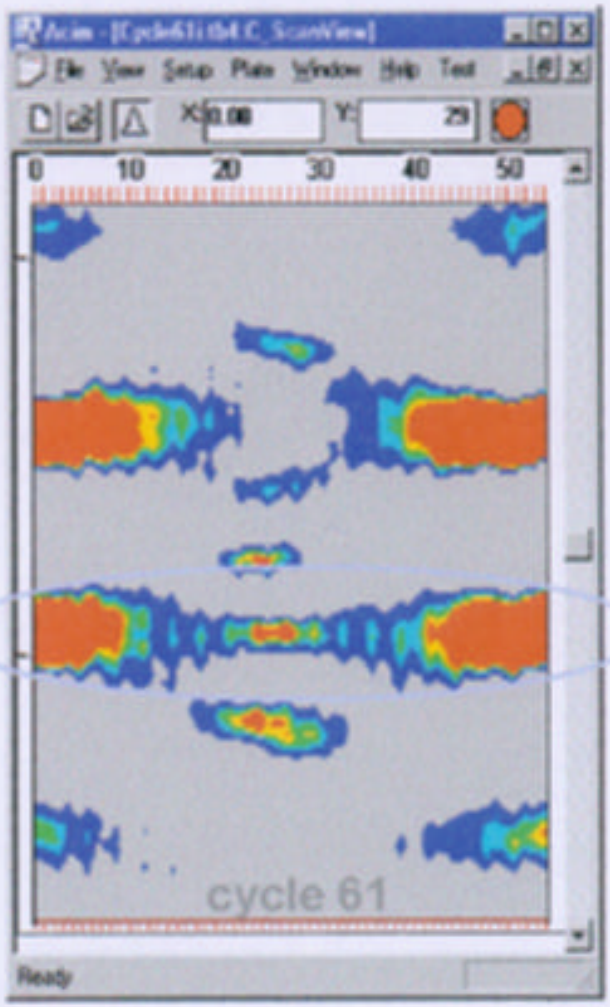

cycle 26
cycle 31
cycle 36
cycle 41
cycle 46
cycle 51
cycle 56
cycle 61

Repeatability - ACIM

Circumference

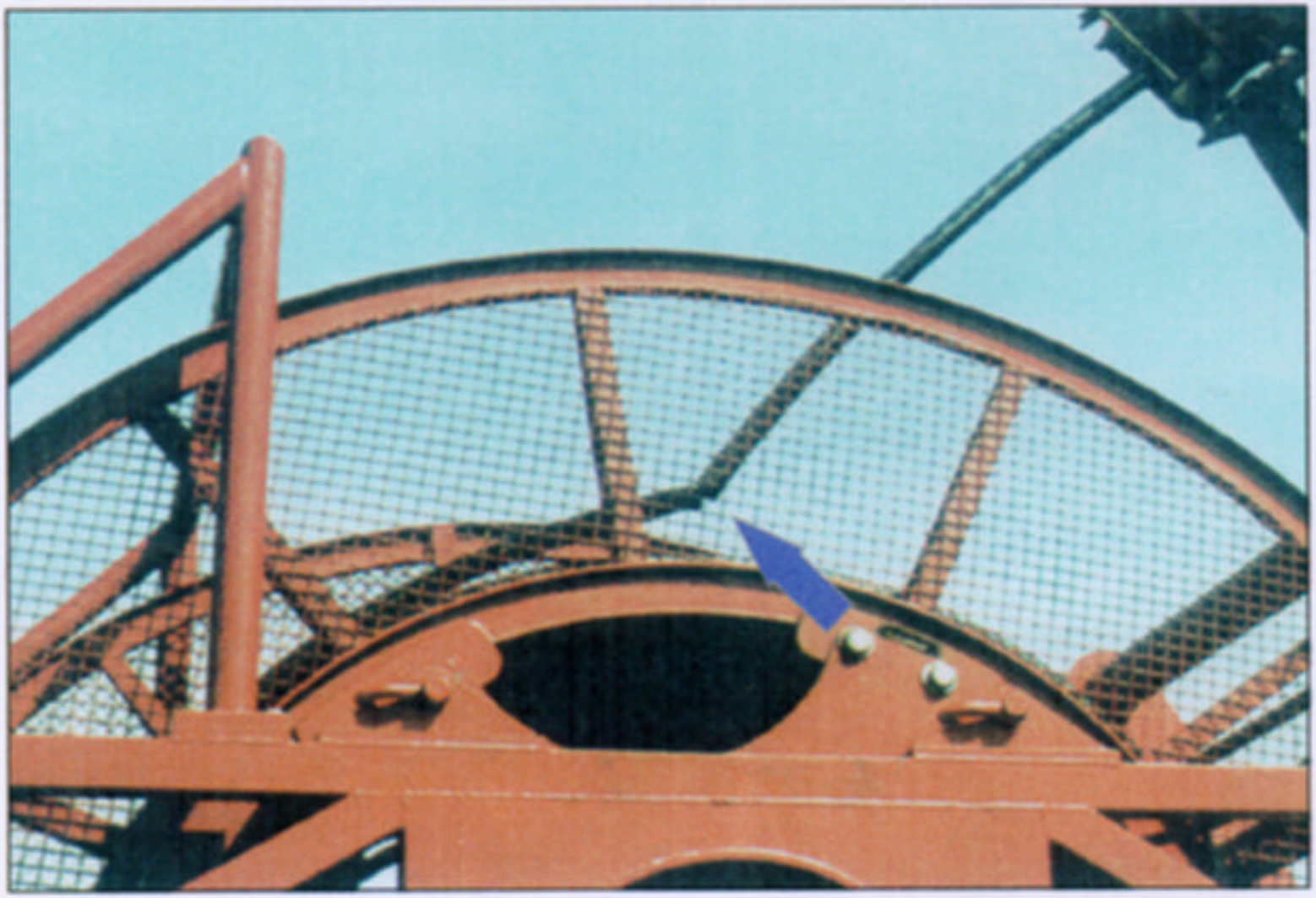
The red color indicates a local decrease of wall thickness on the coiled tubing.

Depth



Coiled Tubing failed at Cycle 69

Repeatability - ACIM



Single Wall vs Double Wall Pipe

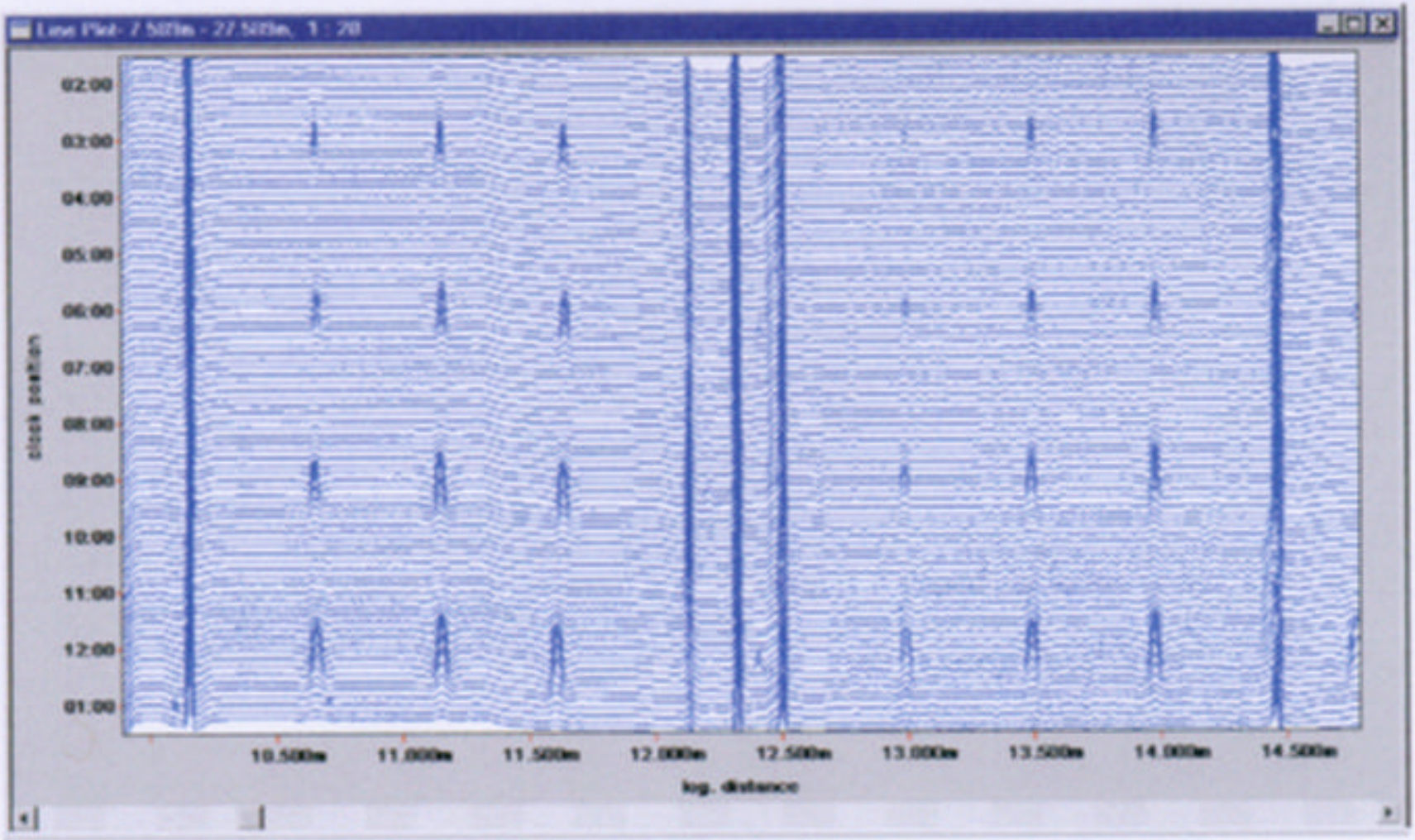
- A lot of experience has been gained in recent years by the industry inspecting heavy wall pipelines
- Three double wall pipelines have been inspected by ROSEN so far:

  8" in 12"

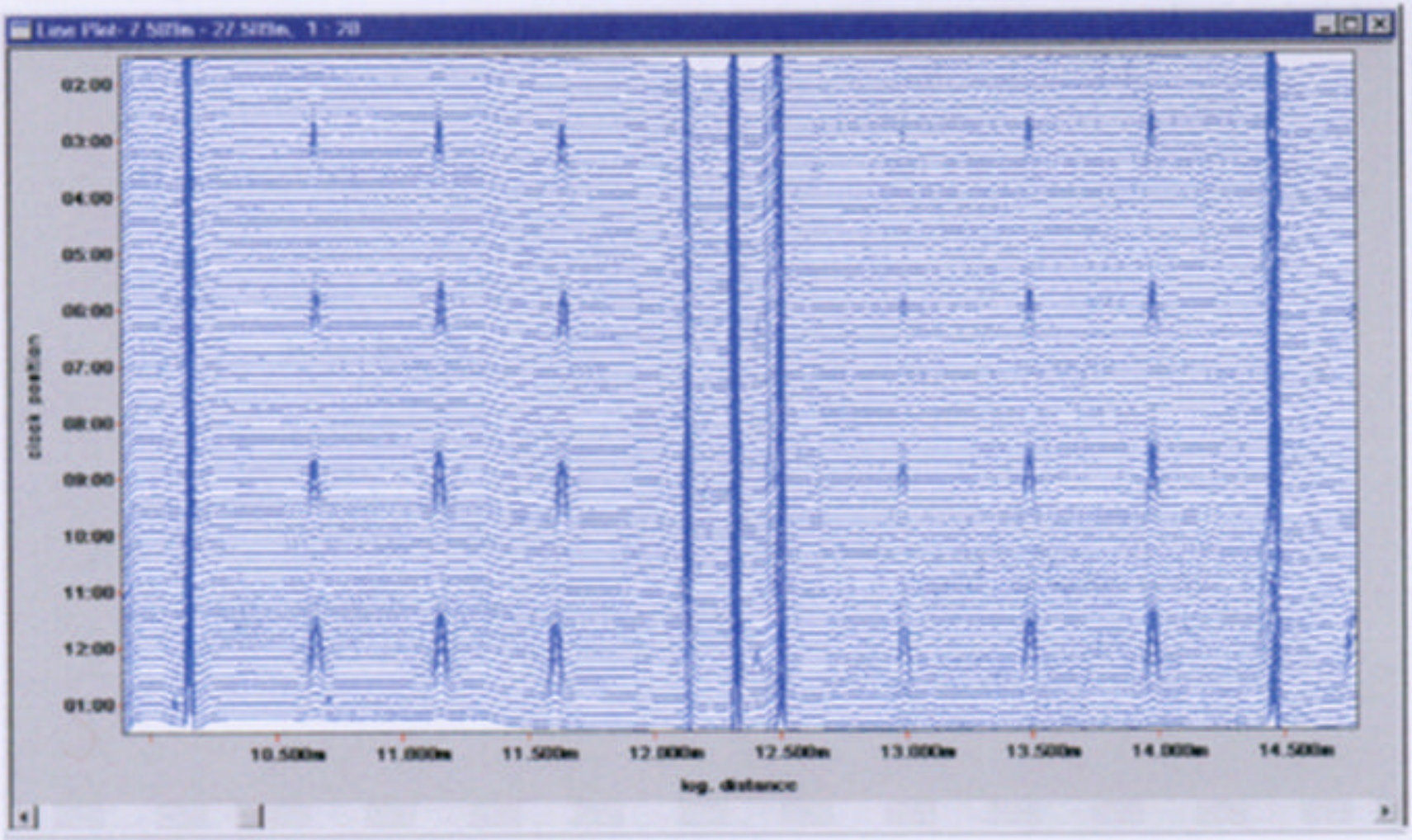
  16" in 20"

  16" in 24"

Single Wall vs Double Wall Pipe



Single Wall vs Double Wall Pipe



Double Wall Pipe: 16” in 20”

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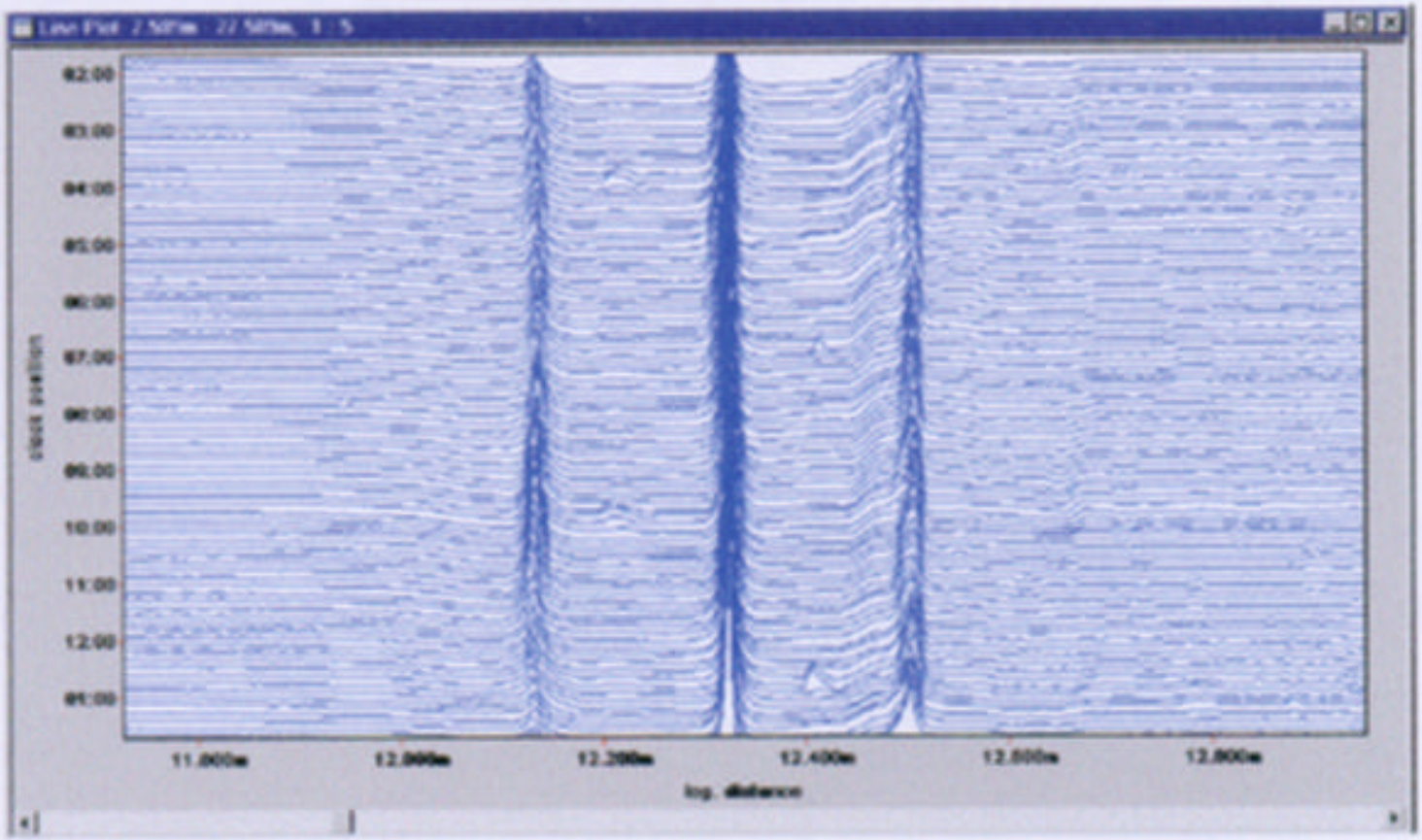
Double Wall Pipe

Increased Complexity



Double Wall Pipe

- Inner pipe can be fully inspected.
- Outer pipe inspection is very limited
- Transition/Weld areas are significantly more complicated for double wall pipe
- Integrity of the outer pipe can not be monitored over time

Double Wall Pipe - Conclusion

Even if a risk analysis would show that a double wall pipeline is safer by design, this would not automatically prove that it is safer to operate and maintain it over its lifetime in comparison to a single wall pipeline.

Based on today's technology monitoring of pipeline integrity shows significant restrictions for the double wall pipelines.

Conclusion

- Pipelines can be successfully monitored by inline inspection.
- Very high sensitivity and repeatability are achieved today even in heavy wall pipe.
- Double wall pipe is more difficult to inspect due to increased complexity.
- Development continues.

"...to meet the need... "

" Thank you for joining this presentation."

Johannes Rosenmoeller

Head of Marketing

ROSEN